Development of acceptance criteria of input data to a site-specific biosphere assessment

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Abstract. In Finland, Olkiluoto Island on the western coast has been selected as a repository site for spent nuclear fuel disposal. With approaching licensing steps, the biosphere assessment demonstrating the long-term safety of the repository is developed into more and more site specific. As there are a large number of input parameters requiring site-specific or at least site-relevant data, it is practically impossible to cover them all by statistically adequate number of site measurements - especially taking the major environmental change due to post-glacial crustal rebound (land uplift) into account - and on the other hand not all literature data are appropriate to be used in the context of the assessment and of the site. In this paper, a screening methodology is presented for classifying site, literature and other data for appropriate use in a site-specific assessment.

1. INTRODUCTION

In Finland, Olkiluoto Island on the western coast has been selected as a repository site for spent nuclear fuel disposal. The site is situated in the municipality of Eurajoki on the Finnish coast of the Baltic Sea, and has been studied for the nuclear waste disposal since the 1980's. Typical to the area is the post-glacial rebound of the bedrock (land uplift) still continuing, with a present rate of approximately 6 mm/y; this affects to the hydrogeochemical and biological system of the repository site - the shallow sea areas off the present island is expected to accommodate lakes, rivers and terrestrial areas in the scale of next few millennia. The properties of future ecosystems at the site are simulated based on the information on the present topography and geological deposits and on the land uplift, and from those simulations ecosystems similar to those at present farther inland are identified (see the paper of Haapanen et al. in this conference).

With approaching licensing steps of the repository, e.g. application for nuclear construction licence in 2012, the biosphere assessment demonstrating the long-term safety of the repository [1] is developed into more and more site specific. As there are a large number of input parameters requiring site-specific or at least site-relevant data, it is practically impossible to cover them all by statistically adequate number of site measurements - especially taking the major environmental change due to post-glacial crustal rebound (land uplift) into account - and on the other hand not all literature data are appropriate to be used in the context of the assessment and of the site; a fusion of site and literature data is needed - statistical and more straightforward methods exist but a key issue is how to validate the data to be considered to be representative to the site-specific assessment context.

2. MATERIAL AND METHODS

Qualifying and merging of input data to the biosphere assessment modelling (Fig. 1) is an iterative process both internally and by feedback and learning from earlier assessments. In the first step of the approach, types of relevant ecosystems are identified (e.g. flow-through and headwater lakes) based on the information on the site at present, and in the past, and on modelling results of the future development of the site.

After identifying of the ecosystem types, their properties are defined in respect of factors affecting to the subsequent selection of the appropriate data; these phases are iterative, too. The characteristics of the ecosystem types would cover e.g. the expected range of pH in the water body or in the soil. The type properties should take into account also environmental changes relevant to the assessment context.

In the data screening phase, described more below, all available data are collected and reviewed for their appropriateness to characteristic conditions and properties of the identified ecosystem types. The data is grouped into totally rejected (i.e. being representative to conditions conflicting with the assessment context; the data itself can be totally good but inappropriate to the specific use), to data of some degree of relevance to describe the overall variability of the parameter in the assessment context, to context-relevant literature data and to data directly specific to the site or its confirmed analogue conditions. It should also be noted that the acceptance criteria cannot be too tight (in some cases the classification needs to be revised during the overall process) as for some parameters and nuclides there is very little or no data, but the models need their input. This is where different kinds of analogues (e.g. chemical, biological, physiological) come into the picture, but as the proper use of the analogues is a wide issue it is left out of the present paper.

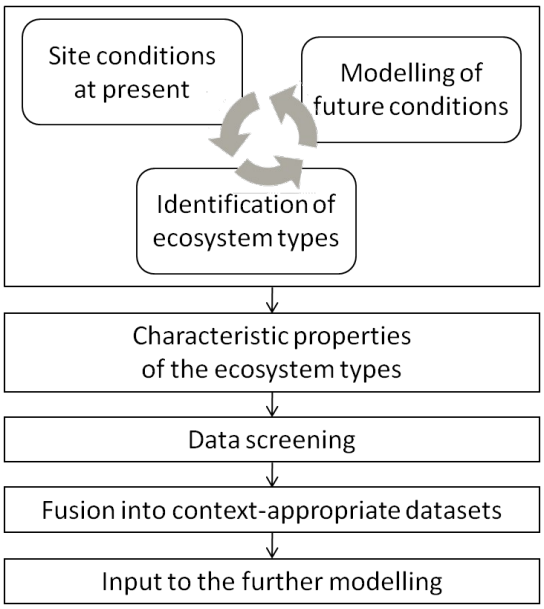

Figure 1. Steps of production of the site-relevant input datasets to the biosphere assessment modelling.

After all available literature and other data sources have been reviewed and classified, the different level of datasets need to be merged to an input data to the modelling (best estimate values for deterministic simulations and inferential statistics for probabilistic analyses) internally as merging all literature data within the class and, in some cases, also across the classes, e.g. merging of site data and the relevant literature data if the site data alone does not have enough statistical strength. In this phase also relevant groupings of data e.g. by taxonomic groups can sometimes be considered - if there are statistically significant differences between the groups, separate treatment in the models, too, may become relevant.

3. RESULTS

In the full paper results on applying the methodology outlined above will be exemplified for some parameters used in the forthcoming biosphere assessment for the Olkiluoto spent nuclear fuel repository.

References

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